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ABSTRACT

A proposed strategy for the National Assessment of Vocational Education (NAVE) uses school-wide data to identify secondary schools where students' academic achievement has been improving at a relatively fast rate and those where it has not. Schools with the most involvement in vocational education can be selected from the two groups. These two sets of schools can then be compared in depth to describe how vocational education is being used. The in-depth study can supplement measures of academic achievement with other measures of student attainment. Results would answer whether secondary schools where student academic achievement is improving at a relatively rapid rate organize and deliver vocational education differently than do schools where student achievement is not improving as fast and whether they have higher levels of student attainment in work-related knowledge and skill. Possible sources of data for identifying schools are accountability systems developed in various states to monitor school improvement and networks. On-site observations and interviews would describe how vocational education fits into the school's curriculum and organization and document teaching methods in vocational and non-vocational courses. This qualitative information would be used to learn what may be distinctive about vocational education in schools where achievement is increasing at a rapid rate. Quantitative data can be used to estimate how changes in student achievement are related to prior changes in school practices. (YLB)

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# Targeted In-Depth Assessment of Promising Practices in Secondary Vocational Education - What Can NAVE Do?[1]

ED 443 965

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**May 6-7, 1999**
**Independent Advisory Panel Meeting**
**National Assessment of Vocational Education**

## Summary

This paper concentrates on a strategy that uses schoolwide data to identify secondary schools where students' academic achievement has been improving at a relatively fast rate, and other schools where it has not. Schools with the most involvement in vocational education can be selected from the group where achievement is increasing relatively fast, and from the group where it is not. These two sets of schools can then be compared in depth, to describe how vocational education is being used in each case. The in-depth study can supplement measures of academic achievement with other measures of student attainment, including work-related knowledge and skills. The results will answer two questions:

- Do secondary schools where student academic achievement is improving at a relatively rapid rate organize and deliver vocational education differently than schools where student achievement is not improving as fast?

- Do secondary schools where student academic achievement is improving at a relatively fast rate also have higher levels of student attainment in work-related knowledge and skill?

Data for identifying schools could come from accountability systems that have been developed in various states to monitor school improvement. Another possible source of comparative schoolwide data would be networks such as the Southern Regional Education Board's *High Schools That Work*, or the U.S. Department of Education's New American High Schools. On-site observations and interviews would be necessary in most cases to describe how vocational education fits into the school's curriculum and organization, and to document teaching methods in vocational and nonvocational courses. This qualitative information would be used to learn what may be distinctive about vocational education in schools where achievement is increasing at a rapid rate. In addition, quantitative data can be used to estimate how changes in student achievement are related to prior changes in school practices, while controlling for demographic characteristics of students.

This strategy for identifying promising practices in secondary vocational education has several advantages, which are explained in this paper:

- The results, and the research process itself, can be directly useful in assisting improvement efforts of schools, districts, and states – as well as helping Congress identify effective uses of vocational education.

- Starting with schools that have shown rapid improvement in student academic achievement is consistent with the emphasis in the 1998 Perkins Act on developing students' academic as well as vocational and

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technical skills, and integrating academic with vocational instruction.

- Using change in student achievement, rather than the level of achievement, as the basis for selecting schools is consistent with the idea that schools can more fairly be held accountable for how fast students improve than for where they start.

- The data to be used are more recent than the information in national longitudinal data sets.

- Using schoolwide data can avoid statistical problems caused by certain kinds of selection bias.

- Comparing schools is more feasible on a large scale than conducting studies that depend on random assignment of students to different treatments.

## Why Use Schoolwide Data?

Some high schools with substantial involvement in vocational education are making rapid gains in student performance, while others are not. Why? One of the central questions for NAVE is to understand how vocational education is being used to advance students' academic and work-related achievement.

To assess the effects of federally funded vocational education on the academic performance and labor market success of high school students, three main kinds of data are available. Advantages and disadvantages of each type of data are reviewed briefly here. The conclusion is that, given the constraints on NAVE's time and resources, the best way to gain insight into promising practices in high school vocational education is to start with available quantitative data on entire high schools, and select certain schools for in-depth qualitative study.

**Longitudinal data on individual students**. First, longitudinal data on individual students from nationally representative surveys such as High School and Beyond (HSB), the National Educational Longitudinal Survey (NELS), and the National Longitudinal Survey of Youth (NLSY) can be used to estimate associations between certain aspects of students' high school experience and their subsequent success at school or work, controlling for students' background characteristics. The main advantage of these surveys is that they comprise large samples of students who represent the national population, and are therefore amenable to statistical analysis. Much of the published research on effects of vocational education has relied on these datasets.

Several reviews of this research have been conducted (Bishop 1989; Boesel et al. 1994; Stern et al. 1995). They point to improvement in the research resulting from the availability of transcript data showing the actual courses taken by students while in high school. Using such data, a number of studies have found that high school vocational courses are more likely to lead to regular employment and high wages when graduates work in jobs where they can use the specific occupational knowledge and skills taught in those courses. On the other hand, students who take more vocational courses in high school are usually found to be less likely to enroll in postsecondary education. These findings are not very surprising.

Another finding that emerges from several studies that use national longitudinal data sets is less obvious. High school students who combine a substantial academic curriculum with several vocational courses have been found to do better than students who omit either one of these two components. This was first noted by Kang and Bishop (1989), who discovered a positive interaction in the HSB data between the number of academic courses and the number of vocational courses in predicting post-high school earnings for males who did not attend college. Arum and Shavit (1995), also using the HSB data, used transcripts to identify students who had taken a set of advanced academic courses, a sequence of vocational courses, or both. Four years after senior year, individuals who had combined academic and vocational courses in high school had the greatest likelihood of being employed in professional, managerial, or skilled jobs, or being enrolled in postsecondary education.

Outcomes for this group were better, or at least as good, as those who had taken advanced academic courses but no vocational education. Levesque, Lauen, Teitelbaum, Alt, Librera, Joyner, and Nelson (1998), in addition to replicating these results with HSB data (tables 61.1 and 64), also found in the NELS data that students who combined a college-preparatory academic curriculum with a specific vocational sequence had gains in mathematics, reading, and science test scores during high school that were similar to the gains of students who took only the college-prep curriculum – and both of these groups gained substantially more than other students (tables 38—41).

The problem with these findings based on longitudinal surveys is that they do not prove anything about cause and effect. The analysis can never fully eliminate the possibility of selection bias–that some unmeasured attributes of students account for both their participation in certain programs and their subsequent performance. For instance, the reason why students who are employed in jobs that use their specific occupational training earn higher wages may be that they enter high school already possessing specific abilities or interests which cause them to choose certain courses where they can excel, and also cause them to perform well on jobs that tap those same interests or abilities. The occupational courses themselves may contribute little or nothing to the abilities and interests that make these people valuable to employers.

Similarly, the reason why students who take more vocational courses are less likely to enroll in postsecondary education may be that they come to high school less interested in the kind of book learning that schools emphasize, so they choose more hands-on courses while in high school, and are also more likeley to stop their formal schooling as soon as they graduate. The vocational courses themselves may do nothing to deter them from going on to college. Finally, the reason why students who combine a strong academic curriculum with an occupational sequence perform better both at school and at work may be that they start high school already possessing more ambition, energy, self-discipline, or awareness of what it takes to do well in the world, which causes them to take a doubly demanding curriculum in high school and also to excel in their post-high school pursuits. Their built-in get-up-and-go might enable them to succeed just as well without the extra coursework.

Social scientists have tried hard to find ways of finessing the selection problem. One of the most sophisticated attempts is Altonji's 1995 analysis of data from the National Longitudinal Survey of the High School Class of 1972, which he boldly describes as "the first systematic study of the effects of secondary school curriculum on postsecondary education and on success in the labor market" (p. 410). Altonji used the average number of courses in each subject taken by all students at a high school as an instrumental variable to predict the number of courses in that subject taken by each student at that high school. This was intended to reduce or eliminate the endogenous component of course-taking by individual students, which is what creates selection bias. He also compared the results with ordinary least-squares regressions. The results using instrumental variables often differed from those using ordinary least-squares, which may indicate that selection bias really is a problem.

Surprisingly, foreign language courses stood out in Altonji's results as the best predictor of both post-high school wages and college attendance (tables 2 and 3). No other academic or vocational subject had a consistently significant association with wages. Altonji grouped vocational courses into "industrial" and "commercial"; both were negatively associated with college attendance. Altonji does not accept these results at face value (though the Modern Languages Association might be pleased if he did!). He surmises that foreign language courses may contribute to "general skill development," or else the result may be due to omitted variables or sampling error. He is puzzled by the small estimated effects of coursework in other subjects, particularly mathematics and science. Unfortunately, despite the attempt to rid the data of selection bias, the findings and discussion do not inspire much confidence in the possibility of reaching clear conclusions about cause and effect.

A final problem with the national longitudinal data sets is that they captured high school experiences from the 1970s (NLS72), 1980s (HSB and NLSY79), or early 1990s (NELS). The information therefore does not shed

any light on changes that may have occurred in high schools during the 1990s. The only new data set of this kind that might inform the current NAVE is a new National Longitudinal Survey of Youth that began in 1997 (NLSY97). Unfortunately, the first wave of that survey did not collect transcript information, and the sample included a predominance of students in grades 9 and 10 who were too young to have had much opportunity to participate in vocational or career-related instruction.

**Comparing groups of students within schools**. A second kind of data comes from comparing certain students in a school with other students in the same school. This can be done for more than one school at a time, if they offer comparable programs. Generally, schools are interested in knowing whether certain instructional practices lead to better performance by students. But simply comparing data for different students can be seriously misleading, again because of selection bias: students may be given certain kinds of instruction *as a result of* their level of performance.

Consider a hypothetical example in which students who report that they make oral presentations in science class also obtain higher scores on a science achievement test. One explanation could be that high-achieving students are asked to make oral presentations because their teachers think they will set a good example for their classmates. Or an entire class in advanced science might be asked to do oral presentations because they have mastered the basics and the teacher believes they are ready for more individual work. In other words, being asked to do oral presentations could be the result, not the cause, of higher achievement. This is another example of selection bias. Consequently, the observed correlation does not imply that assigning more oral presentations for low-achieving students would necessarily improve their performance.

It would be different if a school found that the *average* science score for students in the whole school improved after science teachers for some reason decided to begin assigning oral presentations to a *larger proportion* of students. This finding, based on change scores at the school level, would provide more compelling support for extension of the practice to additional students. This illustrates the benefit of using schoolwide data, as explained below.

Examples of actual studies that have compared groups of students within schools include some evaluations of career academies (Stern, Dayton, and Raby 1998). A career academy is a small learning community in which a group of students take classes together from the same set of teachers for a period of two to four years. The curriculum combines a college-preparatory academic core with vocational courses related to the theme of the academy–for example, health careers, finance, or electronics. Partnerships with employers and other community groups provide internships and other connections between high school and the outside world.

Three separate evaluations of career academies in California have compared the performance of academy students with similar students in the same school. That is, each academy student is individually matched with a nonacademy student of the same gender and race, whose prior academic record (grades, attendance, test scores, disciplinary infractions) is as similar as possible. These evaluations have followed both sets of students over time, and have consistently found that academy students attend school more regularly, earn higher grades, complete more courses, and are more likely to finish high school. However, it is possible that these results are affected by selection bias. If students who take the initiative of applying to a career academy have more of some unobserved positive characteristic such as ambition or planfulness, this could account for some or all of the difference in performance between the two groups. On the other hand, if academies tend to select students who are more troubled or recalcitrant, the observed results would underestimate the true effect of academies. The possibility of selection bias therefore makes the interpretation of results somewhat uncertain.

A similar uncertainty occurs in evaluations which evaluate new forms of vocational education by comparing the performance of successive graduating classes of vocational "completers." If improvements in the vocational curriculum over time result in higher achieving students being attracted to vocational classes, this selection

effect could cause the measured performance of vocational completers to improve, even if there were no improvement in the average performance of students schoolwide. The best way to tell whether this is really happening would be to collect data for the school as a whole.

The standard procedure to protect against selection bias is random assignment of students to the program and control groups. If students are randomly assigned, unobserved characteristics such as ambition or ability to plan or recalcitrance are unlikely to differ very much on average between the program and control groups. Random assignment has often been done in studies of educational practices at the level of the classroom, but it is more difficult to conduct a random assignment study of programs that span more than one classroom. Still, such studies have also been done despite the difficulty and expense. In particular, an ongoing random assignment study of career academies has found, among other things, that students in academies say they receive more support from teachers and peers, and find schoolwork more interesting and relevant, compared with nonacademy students (Kemple 1997). This evaluation also has found that career academy students participate more in career awareness activities and work-based learning. Among students whose prior performance in school was especially weak, academies also reduce the probability of dropping out.

Even when random assignment can be done, however, the results may not be definitive. For example, suppose a high school starts a new program and invites students to apply. From among the applicant pool, some students are selected at random for the program, and the others become the control group. Suppose that both groups are doing well a few years later, but there is no significant difference between their results. A possible explanation could be that the students who applied for the program all had relatively high motivation to succeed, so they all did well whether they were admitted to the program or not. It is also possible that highly motivated students still need well-structured learning opportunities in order to succeed, and that students in the control group were able to find other such opportunities in the school. But if the number of well-structured learning opportunities available in the school is less than the number of potentially motivated students, and if the new program increased the number of opportunities, then eliminating the program would lead to poorer results, since some students in the program or in the control group would be unable to find good learning opportunities. This kind of effect could be detected only by using data for the school as a whole.

**Comparing rates of change between schools**. The third option, collecting schoolwide data, would permit analysis at the school level. This is consistent with many current school reform efforts which emphasize the school site as the locus for planning, implementing, and monitoring improvements (e.g., Coalition of Essential Schools, *HSTW*, Obey-Porter programs). Most high schools are involved in a number of improvement efforts at any given time, with new initiatives happening constantly. In this environment, it is difficult to isolate the effect of any particular initiative because conditions for students not participating in that initiative are also likely to be changing. Nevertheless, it is possible for a school to learn from schoolwide data whether student performance is improving over time, and whether the rate of improvement is faster or slower than for other schools. Given that information, schools can attempt to explain why. The National Center for Research in Vocational Education (NCRVE) has engaged a number of high schools in a cycle of inquiry through which schools compare data in order to learn from their own and one another's experience.[2] Collecting and analyzing data on whole schools therefore can feed directly into the schools' own self-improvement efforts. This is an important advantage of such data.

Using schoolwide data is consistent with the emphasis in the Perkins Act on developing students' academic as well as vocational and technical skills, and integrating academic with vocational instruction. Federal law in 1990 and 1998 views vocational education as an integral part of the high school program. In fact, a review of transcripts for a national sample of 1994 high school graduates found that 97.2 percent of public high school students had taken at least one vocational course, and 90.8 percent had completed at least one specific occupational[3] course (Levesque et al. 1998, p. 12). The average high school graduate in 1994 had completed nearly four Carnegie units in vocational education courses (Levesque et al. 1998, p. 37).

Moreover, many students who take vocational courses go to college after graduating from high school. College-going students from the graduating class of 1982 accounted for 48 percent of all occupationally specific vocational coursework taken by members of that class during their four years of high school (Muraskin 1993, p. 101). The number of students who combine vocational education with college-preparatory academic coursework has grown during the 1980s and 1990s. Among high school graduates who had taken three or more specific occupational courses, the proportion who also completed a course in chemistry rose from 15 percent in 1982 to 34.6 percent in 1994, and the proportion who took physics grew from 7.8 to 13 percent (Levesque et al. 1998, table 36.1).

In the accountability provisions of the 1998 Perkins Act, Congress did not restrict states to measuring outcomes only for students participating in vocational education. Likewise, NAVE's studies of promising practices should not be limited to some subset of students who are defined as "vocational." Such a definition would have to be arbitrary and artificial, given the fact that almost all students take at least one vocational course. Identifying a group of high schoolers as "vocational students" would make no more sense than labeling some as "mathematics students," since virtually all students also take at least one mathematics class. It certainly would be possible to separate out students who took a relatively large number of vocational courses, just as it would be possible to distinguish those who took a lot of mathematics. But this kind of distinction is unnecessary and irrelevant if NAVE's purpose is to discover how vocational education is being used in conjunction with academic instruction to improve the performance of any or all students along a number of dimensions, including academic achievement and preparation for postsecondary education as well as work-related knowledge and skill.

In deciding not to require states to identify a set of vocational students for purposes of accountability, Congress continued a strategy it adopted in the 1994 Improving America's Schools Act (IASA). For nearly 30 years, Title I of the Elementary and Secondary Education Act had distributed federal money to low-income schools for compensatory education, with accountability provisions stipulating that the money could be spent only on students who were identified as meeting specific criteria. In addition to being cumbersome, the attempt to trace money to specific students led to those students being overtly labeled, segregated, and sometimes stigmatized. In 1994 this approach was replaced by IASA's new emphasis on schoolwide improvement. Although the 1998 Perkins Act does not explicitly embrace the schoolwide strategy of IASA, it does avoid a definition of accountability that depends on identifying a subgroup of students.

Given a focus on the whole school, another important principle is that schools should be compared in terms of *change*, not just the absolute level of student performance. Comparing schools in terms of absolute levels of performance can make some schools look bad just because their students come from low-income neighborhoods where educational performance tends to be lower than in more affluent places. Comparing change over time avoids this problem, creating a more level playing field–although shifts in student populations still may have to be taken into account in explaining why student achievement is improving faster in some schools than in others.

## Where to Find Schoolwide Data?

The kind of schoolwide data needed would permit analysis of the trend over time in students' performance, and comparison with other schools. At a minimum, it would suffice to measure performance of a simple random sample of students at one or more grade levels, e.g., grade 12, and to repeat the same measurement from one year to the next. To ensure that changes are not entirely due to shifts in the composition of students, it would also be important to collect demographic data on the students whose performance is measured. Performance measures could include those specified in the accountability section of the Perkins Act: academic and technical skills attained, diplomas completed, postsecondary placements, and participation in nontraditional fields.

One likely source of this data would be individual states that have established accountability systems of their own. A number of states now collect data on individual schools over time, which permit comparisons among schools within a given state. According to *Education Week* (1999, pp. 85—87), the following 13 states maintained web sites that contain "report cards" on individual schools, with test data for more than one year in subjects that include English or mathematics at grade 11. In the following list, an asterisk denotes states where the tests include some performance measures in addition to multiple-choice tests:

Alabama: English/language arts, history/social studies, mathematics, science

Arizona: English/language arts, mathematics

Florida: English/language arts, mathematics

Georgia: English/language arts, history/social studies, mathematics, science

Kentucky*: History/social studies, mathematics, science

Michigan*: English/language arts, history/social studies, mathematics, science

Nevada: English/language arts, mathematics

New Jersey*: English/language arts, mathematics

New York*: English/language arts, history/social studies, mathematics, science

Ohio[4]: English/language arts, history/social studies, mathematics, science

Pennsylvania*: English/language arts, mathematics

Washington: English/language arts, mathematics

West Virginia[5]: English/language arts, history/social studies, mathematics, science.

Ten other states test 11th graders in subjects that include English or mathematics, but either do not include school report cards on their web sites or else do not report data for more than one year. These are:

California: English/language arts, history/social studies, mathematics, science

Idaho: English/language arts, mathematics

Maine*: English/language arts, history/social studies, mathematics, science

Mississippi: English/language arts, mathematics

Missouri*: English/language arts, history/social studies

Montana: English/language arts, history/social studies, mathematics, science

Oklahoma: English/language arts, history/social studies, mathematics, science

South Dakota: English/language arts, history/social studies, mathematics, science

Utah: English/language arts, history/social studies, mathematics, science

Wyoming*: English/language arts, mathematics.

A particularly good source of data on the contribution of vocational education to school improvement is the multistate network called *High Schools That Work (HSTW)*. This is the nation's first and largest effort to combine challenging academic courses and modern vocational educational studies to raise the achievement of high school students who were not enrolled in college-prep courses. As of 1999, the *HSTW* network includes close to 800 schools. The two major goals of the initiative are: (1) to raise the mathematics, science, communication, problem-solving and technical achievement of career-bound youth to the national average; and (2) to blend the essential content of traditional college preparatory studies –mathematics, science, language arts and social studies – with quality vocational and technical studies (Bottoms and Presson 1995; Southern Regional Education Board 1996).

One of the key features of *HSTW* is the biennial assessment of student progress. Every two years, seniors who are classified as "vocational completers" take a special *HSTW* achievement test, based on the National Assessment of Educational Progress tests in mathematics, language, and science. Data from this test, along with results of a student survey, faculty survey, and follow-up of recent graduates, are compiled by the Educational Testing Service in a report to each school. Site visits from *HSTW* staff are occasions to examine school practices in the light of this data. The intent is to engender continuous improvement aided by periodic data collection. Unlike the data routinely collected by state accountability systems, the *HSTW* assessment includes information about vocational and academic courses taken by each student, and reports by students about specific instructional practices relating academic concepts to vocational applications.

Beginning in 1998, some *HSTW* schools started collecting assessment data on schoolwide samples of students, instead of vocational completers only. Twenty-seven *HSTW* sites located in 20 different states[6] collected 1998 data from a fully representative sample of the senior class. Repeating this sampling procedure in the next assessment, scheduled for January-February 2000, would make it possible to compare schoolwide progress among these 27 high schools. Data would become available in the spring of 2000, making it possible to identify schools with relatively fast and slow rates of improvement in student achievement. On-site studies could then be conducted during the 2000-2001 school year, to determine how vocational education is being used in schools with rapid rates of improvement compared to other schools. This would allow time to analyze the qualitative and quantitative information and write up the results before the NAVE interim report is due at the end of 2001.

The decision by these schools to repeat the schoolwide sampling procedure in 2000 will have to be made by August 1999, because it takes several months to get ready for the assessment. Schoolwide sampling in these schools entails an additional cost beyond what *HSTW* normally provides for collecting data on vocational completers. In 1998 the cost of testing the additional students was approximately $65,000, paid by NCRVE as part of its research study on using comparative data for school improvement. To ensure the continuation of this unique source of schoolwide data relating student achievement to vocational education, NAVE might have to provide all or part of the additional cost in 2000.

Another possible source of data on schools that include vocational or work-related education as a central component of their curriculum is the set of New American High Schools identified by the Office of Vocational and Adult Education (OVAE) in the U.S. Department of Education. OVAE is asking these schools to provide trend data on one or more performance indicators in the following categories:

Academic performance: Advanced Placement and SAT scores, other achievement tests, percentage of graduating seniors meeting state university's entrance requirements, or percentage of senior portfolios/exhibitions/projects achieving satisfactory or higher rating;

Technical or work-readiness skills: percentage of seniors in work-based learning who receive a satisfactory or higher rating by employer;

High school graduation rate;

Completion of a career program or major;

Dropout rate: four-year completion rate, or annual dropout rate;

Attendance: average days absent, or average daily attendance;

Discipline problems: number of reported episodes, or number of suspensions/expulsions.

It should be possible for the NAVE staff, assisted by the Advisory Panel and contractors, to determine fairly quickly which state accountability systems can provide useful data, along with *HSTW* and New American High Schools. There may also be other data sets that meet the desired criteria. Possibilities include the Beacon schools recognized by the Annenberg Foundation, schools that have won awards from the Association for Career and Technical Education, or schools participating in the International Skills Olympics for vocational students.

## How to Analyze Schoolwide Data?

The main strategy proposed here is to conduct qualitative studies within a quantitative frame. That is, numerical data would be used to identify schools that show relatively rapid rates of improvement over time. Descriptive information from observations and interviews would then provide insights on how vocational education is delivered in these schools, compared to others. The result will be a demonstration of how vocational education can be part of an instructional package in schools where student attainment is growing relatively fast.

**Qualitative studies within a quantitative frame**. The minimum necessary quantitative data for this analysis would consist of information on multiyear trends in student performance as measured by average scores on academic achievement tests. In addition to data on average performance (mean or median), it would be highly desirable also to measure performance in the high and low portions of the distribution (using quartile scores or standard deviations), so that schools can monitor trends across the whole spectrum of student achievement. Along with standardized tests of academic achievement, measures of work-related knowledge or skill, or at least application-oriented tests of academic achievement, would be especially pertinent to measuring the impact of vocational education[7]. In addition to test scores, other important indicators of student performance would include dropout and graduation rates, and postsecondary placements in work or further education. Follow-up data at least a year after graduation would also be revealing, but few schools or states collect such information.

Given such indicators, analysis would begin by ranking schools according to how fast they are improving over time. The total number of schools to be identified for in-depth study will depend on the total budget available and the amount of qualitative detail desired. A plausible scenario would be to choose schools as follows:

(1) Select three to five states where the accountability systems provide the necessary data on schools. In

each of these states, identify three to five schools where student achievement has improved at a rapid rate, and two or three schools where it has not. This would result in selection of between 15 and 40 schools for direct, in-depth study.

(2) From the 27 schools in *HSTW* with schoolwide data, select three to five schools with the fastest rates of growth in student achievement between 1998 and 2000. Also choose two or three where student achievement has not grown as rapidly. This would add between five and eight schools.

(3) From the New American High Schools, choose another five to eight schools using the same procedure.

These three sets add up to between 25 and 56 schools. If $5,000 were allocated to pay for visiting each of these schools and writing descriptions based on observations and interviews, the total cost would be between $125,000 and $280,000.

Since the central purpose of this study is to understand the role of vocational education, it is necessary to ensure that vocational education has a substantial presence in each of the schools to be studied. Schools in the *HSTW* project may be presumed to satisfy this criterion, because vocational education plays an important part in the key practices promoted by this project. Similarly, attention to career-related instruction is one of the characteristics of the New American High Schools.

However, in choosing schools based on data from state accountability systems, it will be necessary to verify involvement in vocational education before sending out teams to conduct in-depth studies. For instance, if the aim in a particular state is to select five schools where student achievement has grown rapidly and three where it has not, it may be necessary to start with a preliminary set of ten or fifteen fast-improving schools and six or nine slow-improving schools. From this preliminary set, schools for in-depth study can be chosen based on involvement in vocational education. Indicators of involvement in vocational education might include the average number of vocational courses students have taken, or the amount of money budgeted per pupil for vocational instruction. Information on vocational involvement may be obtained from the state education agency, local district offices, or preliminary telephone calls to the schools themselves.

Once schools have been identified based on rate of improvement in student achievement and degree of involvement in vocational education, they can be visited by NAVE staff or contractors to conduct observations and interviews on the role of vocational education. The first question to be answered is whether and how schools where student academic achievement is improving at a relatively rapid rate organize and deliver vocational education differently than schools where student achievement is not improving as fast. Observations and interviews should look for differences along the following dimensions, among others:

- Integrating academic and vocational curriculum and instruction. Do all or most students take a set of challenging academic classes as well as a coherent sequence of vocational courses? Do vocational courses reinforce academic skills and concepts? Do academic courses include work-related applications? Do students engage in projects that link academic and vocational subjects?

- Work-based learning. Do all or most students engage in job shadowing, service learning, internships, school enterprises, or other forms of work-based learning? Are these experiences tied directly to academic courses? Do nonvocational teachers participate in work experiences outside of school, and do they supervise students who do the same?

- Connecting secondary with postsecondary education. Do all or most students satisfy prerequisites for admission to a four-year college or university? Do they acquire occupational skills that will make it

easier for them to work their way through college? Are there explicit arrangements for students to earn college credits while in high school?

In addition, a second important question is whether schools where student academic achievement is improving at a relatively fast rate also have higher levels of student attainment in work-related knowledge and skill. State accountability systems seldom if ever include measures of work-related knowledge and skill, so whatever data are available will have to be collected as part of the in-depth study of each school. Bishop (1999) has proposed a set of possible measures. Along with measures of students' actual knowledge and skill, it will also be useful to describe dimensions such as:

- Career-related curriculum. Does the high school offer a set of curricular themes related to broad industry groupings or occupational clusters? Do all or most students choose such a theme? Do students share their core academic classes (English, mathematics, social studies, science) with others who have chosen the same theme?

- Postsecondary pathways. Do curricular themes in high school lead directly to opportunities for employment and further education? Do students receive any kind of formal certification along the way?

The core of the strategy proposed here would use descriptive information about these kinds of dimensions to compare schools where student performance is improving rapidly with schools where it is not. If schools with fast growth in student achievement organize and deliver vocational education differently than other schools, it will be possible to conclude at least that rapid gains in student attainment can occur when certain kinds of vocational education are practiced. The results will not prove that observed differences in programs or practices caused the differences in student performance, since it is conceivable that rapid growth in student performance is what permits these practices to be adopted. This can be debated. But it will still be useful to Congress and the field simply to know whether schools with rapid improvement are practicing a different kind of vocational education.

Specific data collection procedures for the in-depth, on-site studies will not be detailed here, but there are several closely related precedents. Bradby and Teitelbaum (1998) piloted this kind of qualitative study within a quantitative frame for NCRVE, using data from *HSTW*. Rock and Ham (1999) describe a similar approach being used to evaluate Accelerated Schools. Hudis and Visher (1999) give descriptions of New American High Schools which show how qualitative accounts can compare certain practices among schools. Stasz (1999) outlines how qualitative studies of high schools can be conducted for NAVE.

**Purely quantitative studies**. With aggegrated data from a few dozen schools, it is also possible to conduct purely quantitative analysis. Bloom (1999) has explained how to use trend data to test whether a particular intervention has had a significant impact on a set of schools. Under plausible assumptions, a set of 20 schools would be sufficient to detect an effect size of only 0.2 standard deviation. The virtue of this method is that it supports fairly strong inferences about cause and effect, based on changes in student performance after the intervention. However, Bloom's procedure assumes that schools are adopting a well-defined new program or practice, beginning at a particular point in time. In most high schools, new initiatives are emerging all the time, so Bloom's method may not be appropriate.

Nevertheless, aggregate data from a set of schools over time may be used to detect whether changes in school practices are associated with subsequent changes in student performance. Standard regression analysis can be applied here if the number of schools exceeds 30, and preferably more. Changes in student body characteristics can also be taken into account. Given NAVE's two-year timeline, this kind of analysis would require retrospective data on school practices.

Additional kinds of analysis can be conducted if data are available on individual students, including not only measures of their performance and background characteristics but also course-taking data and other indicators of their educational experience. For example, *HSTW* collect such information in their biennial assessment of seniors. Statistical techniques like hierarchical linear modeling can be used to measure the degree of association between students' individual educational histories and their performance on tests, as well as how those associations depend on school characteristics. For instance, the association between test scores and whether a student has taken a sequence of vocational courses may depend on whether most students in the school take such a vocational sequence, or only a few. NAVE may want to commission a special analysis of the unique *HSTW* data set to answer questions such as this.

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